



GUIDED BY QUALITY

FY2018 Annual Report



State Hygienic
Laboratory

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LETTER FROM THE DIRECTOR: GUIDED BY QUALITY

Fiscal year 2018 was a year of transition for the State Hygienic Laboratory. After more than a decade, the lab bid farewell to Director Christopher Atchison and welcomed me as interim director in January 2018. I became the permanent director in June 2018.

This annual report is a continuation of the State Hygienic Laboratory reporting to Iowans the valuable accomplishments of the state public health laboratory. As the leader of Iowa's statewide laboratory system, SHL connects laboratories throughout Iowa both locally and nationally.

The theme of this annual report is "Guided by Quality." One of my goals as director is to evolve the current quality program to a quality management system (QMS) that engages all laboratory sections. A laboratory quality management system is a systematic, integrated set of activities that establish and control the work processes from pre-analytic through post-analytic, manage resources, conduct evaluations and make continual improvements to ensure consistent quality results. From sample receiving to accounts payable, QMS connects all sections of the laboratory.

Working under a true QMS broadens the scope of quality activities to obtain the highest level of quality in the product produced or service rendered. A QMS integrates all the quality elements into the work process. Through the QMS, laboratories improve their processes to be cost effective and scientifically sound, and affect positive outcomes. QMS requires the laboratory to consider not only the quality control and quality assurance activities, but also the purchasing and inventory processes, personnel training, test system assessment, instrument qualification, information technology support, document control and so forth. In a QMS, deviations from the expected performance are reviewed by management so cross-cutting problems can be resolved at an institutional level.

With changes in leadership come changes in direction. The laboratory is re-focusing on the Core Functions of public health laboratories, which are: Disease Prevention, Control and Surveillance, Integrated Data Management, Reference and Specialized Testing, Environmental Health and Protection, Food Safety, Laboratory Improvement and Regulation, Policy Development, Emergency Response, Public Health Related Research, Training and Education, and Partnerships and Communication.

This past year was a difficult year financially. Expenses significantly outpaced funding. There were reductions in some anticipated funding and some programs decreased in the volume of testing previously performed. The reductions

in revenue resulted in the lab administration reducing expenses by the elimination of some administrative positions.

We know that FY2019 will continue to bring change and challenges to SHL. If we are "guided by quality" as we make these changes, we will continue to provide the reliable test results that the citizens of Iowa have come to expect and deserve.



Michael A. Pentella

Michael A. Pentella, Director



STATE HYGIENIC LABORATORY MISSION

The State Hygienic Laboratory at the University of Iowa protects and improves quality of life by providing reliable environmental and public health information through the collective knowledge and capabilities of our organization.

THE 11 CORE FUNCTIONS AND CAPABILITIES OF A STATE PUBLIC HEALTH LABORATORY

1. DISEASE PREVENTION, CONTROL AND SURVEILLANCE
2. INTEGRATED DATA MANAGEMENT
3. REFERENCE AND SPECIALIZED TESTING
4. ENVIRONMENTAL HEALTH AND PROTECTION
5. FOOD SAFETY
6. LABORATORY IMPROVEMENT AND REGULATION
7. POLICY DEVELOPMENT
8. EMERGENCY RESPONSE
9. PUBLIC HEALTH-RELATED RESEARCH
10. TRAINING AND EDUCATION
11. PARTNERSHIPS AND COMMUNICATIONS

OFFICE OF THE DIRECTOR

MICHAEL PENTELLA, Director
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The Office of the Director consists of seven key functional units that enable the State Hygienic Laboratory to achieve its statutory charge set forth in the Iowa Administrative Code in four areas: scientific, consultative, applied research and education and training.

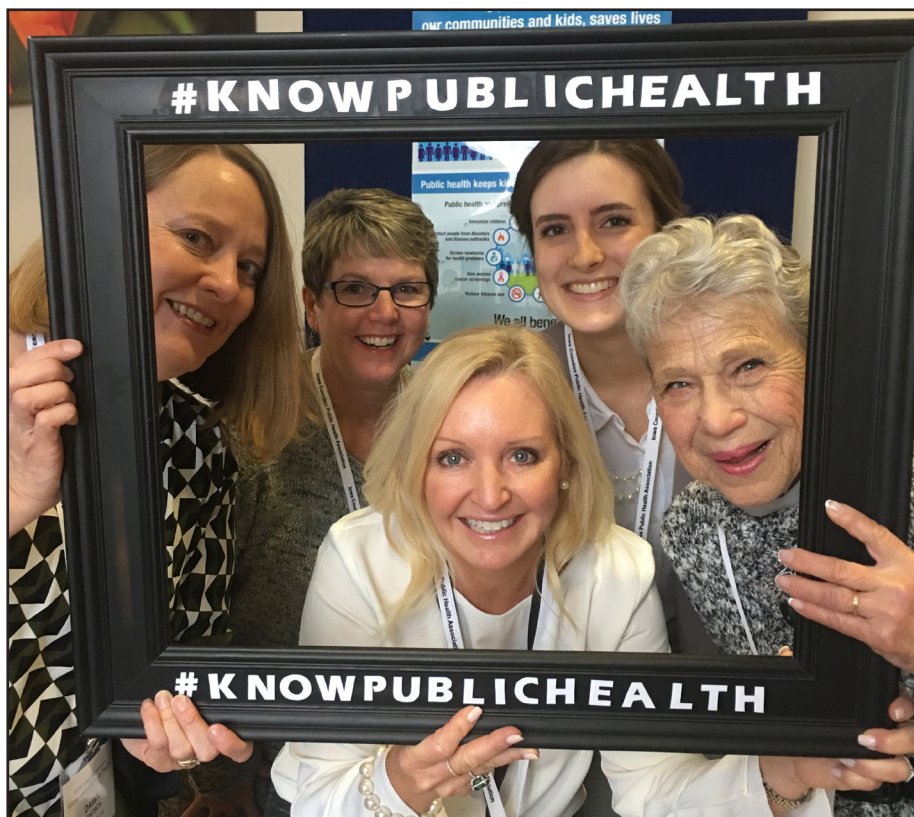
EDUCATION, TRAINING AND PROFESSIONAL DEVELOPMENT

BETH HOCHSTEDLER: beth-hochstedler@uiowa.edu

SHL's educational programs reach every county in Iowa through training for laboratorians, first responders, water and wastewater operators, sanitarians and others. Educational topics include emergency preparedness, infectious diseases, newborn screening, biosafety, biosecurity and water quality.

In addition to leading training programs for the current environmental and public health workforce, SHL prepares the future workforce through fellowships, internships, teacher externships and other initiatives.

In fiscal year 2018, SHL collaborated with colleges and schools across Iowa to develop and lead a variety of Science, Technology, Engineering and Math (STEM) programs that create an awareness of and encourage students to pursue careers in environmental and public health laboratory science.



Public health partners Dawn Gentsch (left) and Louise Lex (right) pose with SHL's Beth Hochstedler (center), Sherri Marine (back row, left) and Jenny Ostrowski.

HIGHLIGHTS

- Provided education and training for more than 12,700 people across Iowa and the nation.
- Supported 141 training events in Iowa, and 25 national and international events.
- Hosted 12 internships and four practicums for college students studying in Iowa, Indiana, Minnesota and Virginia, and one CDC Public Health Associate with a focus on laboratory management and leadership.
- Reached more than 7,450 students through 82 STEM outreach activities.
- Hosted two teacher externships at the SHL Coralville location and two teacher externships at the SHL Milford location.
- Received grant funding from the American Public Health Association (APHL) to develop the CDC Virtual Knowledge Exercise, Phase 5.
- Represented SHL and the University of Iowa by serving on the Iowa Governor's STEM Advisory Council.
- Presented the poster, "iExplore Laboratory Science: Developing the Future Public Health Workforce" at the Iowa Governor's Conference on Public Health.
- Presented "Data without Snores: Communicating Your Data Effectively" at a preconference workshop at the APHL Annual Meeting.

CENTER FOR THE ADVANCEMENT OF LABORATORY SCIENCE (CALS)

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CALS is a unique training space located in the lower level of the Coralville SHL facility. It consists of a classroom and fully functional laboratory for hands-on science and learning, and an adjoining conference room with seating for up to 150. The center is a public venue intended for use by environmental and public health professionals, education groups, and community businesses and organizations. It is managed by the SHL Office of Education, Training and Professional Development.

HIGHLIGHTS

- Instrumentation, including microscopes and interactive white boards, were purchased for the CALS training laboratory through funding from the Roy J. Carver Charitable Trust. This equipment is used to provide interactive, hands-on training for the current and future workforce.
- Since opening in 2014, CALS has hosted nearly 26,000 people for training during approximately 1,300 events.
- In fiscal year 2018, CALS hosted 297 meetings and events attended by approximately 5,800 people.



Alex Trannel (right) assists visiting clinical lab scientists during a workshop held in the CALS.

EMERGENCY PREPAREDNESS AND RESPONSE

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The Office of Emergency Preparedness strengthens Iowa's public health system to respond to biological, chemical and radiological threats. This includes response to credible threat events involving unknown substances; public health and environmental emergencies, including potential biological or chemical threats; pandemic influenza; disease outbreaks such as Ebola; and environmental or natural disasters, including chemical spills and flooding.

SHL is part of the Laboratory Response Network, the Food Emergency Response Network and the Radiological Emergency Response Team. The office also works with the following partners.

- Local agencies – local public health, local emergency management, HazMat teams, fire departments, law enforcement and sentinel/clinical laboratories
- State agencies – Iowa Department of Public Health, Iowa Homeland Security and Emergency Management, Iowa Department of Natural Resources, 71st Civil Support Team and the University of Iowa Department of Public Safety
- Federal Agencies – Centers for Disease Control and Prevention, Federal Bureau of Investigation and United States Postal Inspection Service
- Nonprofit Agencies – Safeguard Iowa and Association of Public Health Laboratories

HIGHLIGHTS

- Tested 36 clinical isolates for agents of bioterrorism.
- Presented “Case Studies: How a Public Health Laboratory Responds to Emerging Infectious Diseases and Credible Threats” at the Public Health Preparedness Summit in Atlanta and the Iowa Governor's Conference on Public Health in Des Moines.
- Led the SHL team as one of eight state public health laboratories that participated in a national study to evaluate the safety and accuracy of the MALDI-TOF Mass Spectrometry equipment used for testing.



Specimens stored securely

GENOMICS

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Genomics is the analysis of the sequence, structure and function of the genome. Its developing use is seen as creating a significant improvement in personalized health. The purpose of the Office of Genomics is to explore the implications, challenges and opportunities associated with the use of genomic information, focusing on the newborn period.

The office works closely with the Newborn Screening section, which identifies infants at risk for more than 49 inherited diseases by testing a small bloodspot obtained from a simple heel stick shortly after birth. Genomics works similarly with the Maternal Screening program to identify babies at increased risk of developmental delays with the intent of improving delivery and outcomes.

In support of the Newborn and Maternal Screening sections, the Office of Genomics is reviewing recent advances in laboratory methods such as next generation sequencing and cell-free DNA to determine possible advantages of these methods as compared to current testing methods.

HIGHLIGHTS

- SHL developed proof of concept data analysis that normalized data from the Iowa and Minnesota newborn screening laboratories, and demonstrated equivalent statistical data distributions for both states. This affirms newborn screening data normalization as a tool for improved screen performance. In collaboration with the Minnesota Newborn Screening Program, the SHL presented data at the APHL Newborn Screening and Genetic Testing Symposium describing newborn screening laboratory data normalization.
- A community engagement event was held to recruit 28 Iowans from the general population to talk about newborn screening disorders and public perception of the Iowa Newborn Screening Program. In collaboration with the Iowa Department of Public Health Center for Congenital and Inherited Disorders (CCID), the SHL provided subject matter expertise and administrative support for data collection and completion of the research study to determine the perspective of the Iowa public as it pertains to newborn screening. Input from the participants will be used to develop CCID policy on issues such as adding new disorders to the Iowa newborn screening panel and how test results are reported to parents.



INFORMATION TECHNOLOGY

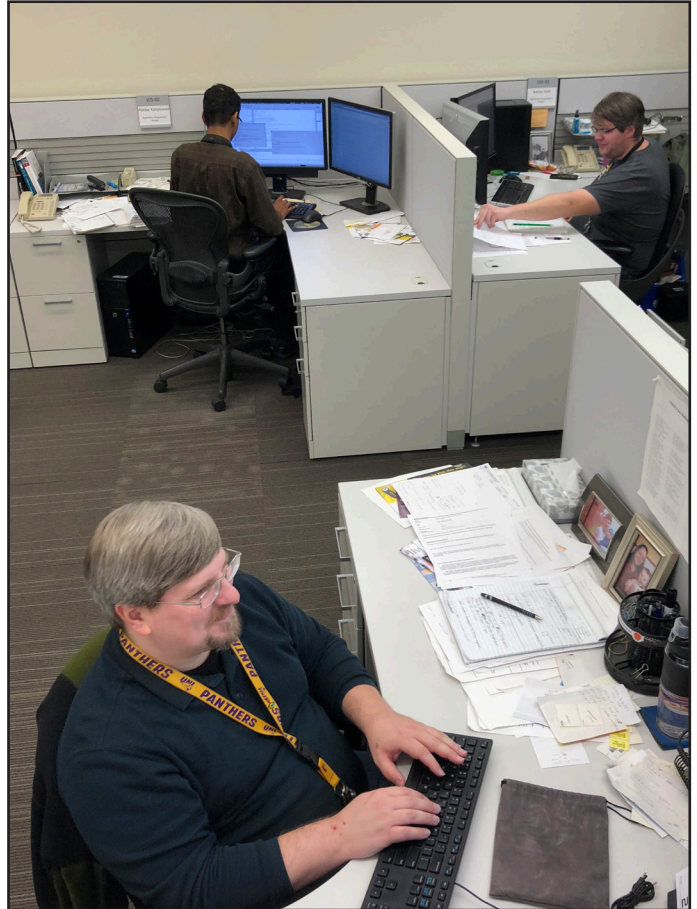
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The Office of Information and Technology securely provides comprehensive IT services to the three SHL locations that support around-the-clock laboratory operations for SHL's Newborn Screening, clinical testing, environmental health, and Emergency Preparedness and Response programs.

The State Hygienic Laboratory is regulated by many national and state agencies, each with their own data security and confidentiality requirements. To be compliant with mandated rules and regulations from such agencies, the office operates a rigorous set of security measures, including firewalls, encryption, tiered access control protocols and monitored surveillance systems.

HIGHLIGHTS

- The South Carolina Department of Health and Environmental Control's Public Health Laboratory became the third state public health laboratory to implement the SHL's OpenELIS Laboratory Information Management System, and the first to utilize American Public Health Laboratories' Informatics Messaging System (AIMS) Cloud Platform for hosting.
- The exchange team applied for and was awarded an EPA Exchange Network grant totaling \$300,000 over the next three years. This grant will fund the migration of the Hygienic Laboratory's Safe Drinking Water Act testing to the EPA's new national reporting system, Safe Drinking Water Information System Prime.



Matt Bielicke in the Office of Information Technology



PUBLIC POLICY

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The Office of Public Policy strengthens and safeguards our public health system through advocacy for public health labs with local, state and federal partners. It also provides and facilitates linkages to expert testimony, guidance and comments on pending or existing legislation.

The State Hygienic Laboratory's mission is disseminated by Public Policy through objective, timely information to government agencies, elected officials and key stakeholders. One goal of the office is to foster and maintain relationships to promote shared understanding and advancement of public health in Iowa.

Public Policy also tracks legislation related to Iowa's public health system; provides educational materials to Iowa policymakers through open forums and Hill Day events; and interfaces with state educational professionals, and environment and public health partners.

HIGHLIGHTS

- Organized two public legislative learning event tours. Events such as these provide an opportunity to showcase stewardship of SHL as a state asset and provide insight into emerging health threats. Laboratory tours highlight activities of environmental and public health significance in the areas of service, education and research.
- Monitored regulatory response to the Iowa Medical Cannabidiol Act and other bills related to public and environmental health.
- Co-chaired the Iowa Governor's Conference on Public Health, which engaged nearly 500 public health professionals and practitioners.
- Guided the development of informational material to inform public health partners and stakeholders about laboratory priorities.
- Mentored CDC Public Health Associate Program Fellow and UI College of Public Health intern.



Travis Henry (left), discusses newborn screening with Rep. Mary Mascher and Sen. Kevin Kinney.

RESEARCH AND DEVELOPMENT

LUCY DESJARDIN: lucy-desjardin@uiowa.edu

The Office of Research and Development oversees internal and external efforts to advance laboratory capabilities by engaging in applied research with an emphasis on state-of-the-art molecular applications. The office evaluates emerging methodologies and activities, including test methods and instrumentation. It also prepares competitive grant applications to support these enhanced activities.

SHL scientists collaborate with federal and state partners such as CDC, APHL, FDA and USDA, and with University of Iowa researchers and students in projects that include development of test methods and surveillance for pathogens of public health significance.

HIGHLIGHTS

- The office led the implementation of next generation sequencing (NGS) and NGS bioinformatics, leading to numerous new sources of funding and positioning SHL as a potential leader in this rapidly developing field. This technology is critical for outbreak investigations in Iowa as NGS is replacing the outdated Pulsed Field Gel Electrophoresis system at both the CDC and FDA. Several new projects and funding have become available. For example, we were awarded a competitive grant to perform Mycobacterium tuberculosis NGS for the CDC, one of only five laboratories, nationally.

(Continued)

Poster Speed Dating Selected Poster
Sunday 12:00-12:30 pm Ballroom DE

Genomic similarity of *Legionella pneumophila* isolated from routine monitoring of hospital premise plumbing systems

Wes Hottel, MS, Valérie Reeb, PhD, Nancy Hall, BS, MT(ASCP) and Lucy Desjardin, PhD
University of Iowa College of Public Health and State Hygienic Laboratory, Iowa City, Iowa

Abstract

Whole genome sequencing (WGS) was performed on *Legionella pneumophila* strains isolated from various locations of hospital premise plumbing systems as part of a routine monitoring program in order to better understand strain diversity over time. 46 *Legionella pneumophila* (Lp) isolates from two hospitals were analyzed; Hospital A (collected 2013-2016) was predominantly Lp serogroup 1 (Lp1) and Hospital B (collected 2013-2016) was predominantly Lp serogroup 4 (Lp4). The selection of Lp1 isolates from serogroup 1 lineage continued to be observed over time within the same facility and/or same location. Selection of the Lp4 isolates from Facility B also focused on maximizing temporal range. wgMLST analysis of Illumina MiSeq Next Generation Sequence (NGS) data showed that there were two sequence type (ST) populations in Hospital A. One cluster belonged to ST36, known to be associated with various outbreaks in the US and a environmental Lp isolates globally. ResFinder identified a beta-lactam resistance gene, associated with the Paris strain plasmid (pLPP) which appeared to be stable in isolates at wgMLST scheme and belonged to ST378. A search of the International ST database found that isolates with this ST have been recovered in Canada and Europe but not yet detected and we plan to examine specific gene content differences among isolates in greater detail. This work allows for better understanding and characterization of *Legionella* species that colonize hospital plumbing systems and may guide future risk management strategies and actions needed in response to detection of these bacteria.

Methods

Isolate selection: 46 *Legionella pneumophila* (Lp) isolated from hospital water samples collected during routine surveillance using Standard Method 9062J. When possible, isolates recovered from the same site over time were selected.

- Hospital A: 23 Lp serogroup 1 (Lp1) (March 2012 to March 2015)
- Hospital B: 22 Lp serogroup 4 (Lp4) and one Lp1 (July 2013 to August 2016)

Culture: Frozen isolates were grown on BCYEa agar (2 days, 37°C), then a single colony was transferred to new BCYEa plate (2 days, 37°C).

Nucleic acid isolation: QIAcube (Qiagen) using QIAamp DNA Mini kit and RNeasy A.

Library prep: Illumina Nextera XT DNA library prep kit and Nextera XT Index kit for multiplexing following CDC's NGS PulseNet protocol.

Sequencing: 23 libraries pooled at equimolar concentrations per run; Illumina MiSeq using MiSeq reagents v2 kit (2-250 bp cycles).

Bioinformatics analyses: Whole-genome multilocus sequence typing (wgMLST) was performed using BioNumerics v. 7.5. wgMLST allelic profiles were used to generate a dendrogram based on pairwise comparisons of allelic similarity. Sequence Type (ST) was determined using the momp3 algorithm <https://github.com/bioinfo-core-BGU/momp3> (Gordon et al. 2017, *Clin Microbiology and Infection* 23:5).

ubbins software was used to identify potential regions of recombination based on presence of elevated SNP density) and to reconstruct a maximum likelihood phylogeny based on a SNP matrix excluding putative recombination sites. Highly related reference genomes were selected to run on each ST: Lp Paris for Lp1 ST1 and Lp Philadelphia for Lp1 ST36. There was no close reference for Lp4 ST378.

Results

Figure 1. wgMLST of *Legionella pneumophila* isolates from Hospital A (orange) and Hospital B (blue)

Figure 2. Recombined regions as defined by Gubbins and maximum likelihood phylogeny of Hospital A Lp1 ST1 isolates

Figure 3. Maximum likelihood phylogeny for Lp1 ST36 (Philadelphia strain as a reference)

The indicated regions correspond to approximate locations of the recombinant sites on linearized reference genome.

- Blue regions indicate predicted recombinant regions unique to a single isolate
- Red regions indicate predicted recombinant regions shared by two or more isolates

All ST1 strains are from the 9th floor West of Hospital A and are closely related. The green box shows a sub-cluster in one sampling location (9W1). The purple box shows a sub-cluster from a second sampling location (9W2).

Conclusions

- wgMLST shows close relationships between *Legionella* with the same ST over time. Hospital A has two distinct populations with unique spatial colonization patterns. ST1 is restricted to one area of the hospital (9th floor west), and ST36 is spread throughout. Similarly, ST378 is also widely distributed throughout Hospital B.
- SNP analysis of isolates of the same ST revealed the presence of some sub-clusters associated with a single hospital room over time.
- Regions of putative recombination identified by Gubbins occur at similar genomic locations.
- The regions of putative recombination identified by Gubbins occur at similar genomic locations. Analysis of the genes in these regions is in progress.

Acknowledgments

We are deeply grateful to Brian Raphael, PhD, Centers for Disease Control and Prevention for his guidance on the study design, performing the data analyses, result interpretation, and helpful discussions.

This study was funded by Epidemiology and Laboratory Capacity Advanced Molecular Detection Cooperative Agreement with the CDC, and a grant from the Center for Health Effects of Environmental Contamination, University of Iowa.

Lucy DesJardin presents a poster about Legionella at the Association of Public Health Laboratories' annual meeting.

HIGHLIGHTS

(Continued)

- **Reeb, V., B. Raphael, W. Hottel, N. Hall and L. DesJardin.** WGS Analysis of *Legionella pneumophila* Reveal Diversity within and Across Water Samples over Time in a Hospital Premise Plumbing System. International Conference on Emerging Infectious Diseases, Atlanta, GA. (Aug. 26–29, 2017). Poster.
- **Reeb, V.** Applications of Next Generation Sequencing in Public Health Surveillance and Outbreak Investigations. University of Iowa Hospitals and Clinics Epidemiology seminar series (Sept. 8, 2017). Oral presentation.
- **Hottel, W., V. Reeb, N. Hall, and L. DesJardin.** Genomic similarity of *Legionella pneumophila* isolated from routine monitoring of hospital premise plumbing systems.
 - o CDC AMD day 2017. Atlanta, GA (Sept. 26, 2017). Poster.
 - o Iowa Informatics Symposium, University of Iowa (Mar. 23, 2018). Poster.
 - o Great Plains Emerging Infectious Diseases Conference, Center for Emerging Infectious Diseases, College of Public Health, University of Iowa (Mar. 29-30, 2018). Oral presentation.
 - o College of Public Health Research Week, University of Iowa, Iowa City, IA (Apr. 3, 2018). Poster. Winner of the Center for Health Effects of Environmental Contamination (CHEEC) award.
 - o APHL annual meeting, Pasadena, CA (June 2-5, 2018). Poster.
- **Von Stein, D., C. Lord, G. Kline, A. Trannel, K. Oni, M. Harris, N. Hall, G. Moet, S. Cochran, V. Reeb, W. Aldous, and R. Jepson.** Iowa's Rapid Response to a *Salmonella* Braenderup Outbreak in the Age of Culture-Independent Diagnostic Testing and Whole-Genome Sequencing. InFORM 2017 Conference, Garden Grove, CA (Nov. 6-9, 2017). Poster.
- **Reeb, V.** Food Safety in the Genomic Era. Iowa Food Safety Task Force Meeting at the State Hygienic Laboratory in Coralville, IA (Nov. 30, 2017). Oral presentation.
- **Reeb, V., B. Albaugh, J. Elwood, J. Boman, R. Jepson, J. Benfer, E. Twait, and L. DesJardin.** Comparative methods for isolation of high quality genomic DNA from *Mycobacterium tuberculosis* for next generation sequencing. College of Public Health Research Week, University of Iowa, Iowa City, IA (Apr. 4, 2018). Poster. Winner of the best staff poster award.

HIGHLIGHTS

- **DesJardin, L, V. Reeb, A. Costello and R. Jepson.** *Mycobacterium tuberculosis* Next Generation Sequencing: Hitting the Easy Button. APHL *Lab Matters* (Spring 2018).
- **Reeb, V. and L. DesJardin.** Application of Next Generation Sequencing in Public Health Surveillance and Outbreak Investigations.
 - o Clinical Pathology Didactics, University of Iowa Hospitals and Clinics, Iowa City, IA (May 2, 2018). Oral presentation.
 - o Public Health Lab Techniques Course, State Hygienic Laboratory, Coralville, IA (May 4, 2018). Course.
- **Twait, E., V. Reeb, J. Benfer and L. DesJardin.** An Alternative to Liquid Handling Robots in Next-Generation Sequencing: Streamlined Semi-Automated DNA Library Preparation Incorporating Electronically Adjustable Tip Spacing Pipettes. APHL Annual meeting, Pasadena, CA (June 2-5, 2018). Poster.
- **Reeb, V., A. Costello, J. Elwood, R. Jepson, J. Benfer, E. Twait and L. DesJardin.** Comparative *Mycobacterium tuberculosis* Culture and DNA Isolation Methods for Next Generation Sequencing: Time, Cost, Quality of NGS Data. APHL annual meeting. Providence, RI (June 11-14, 2018). Best poster award.

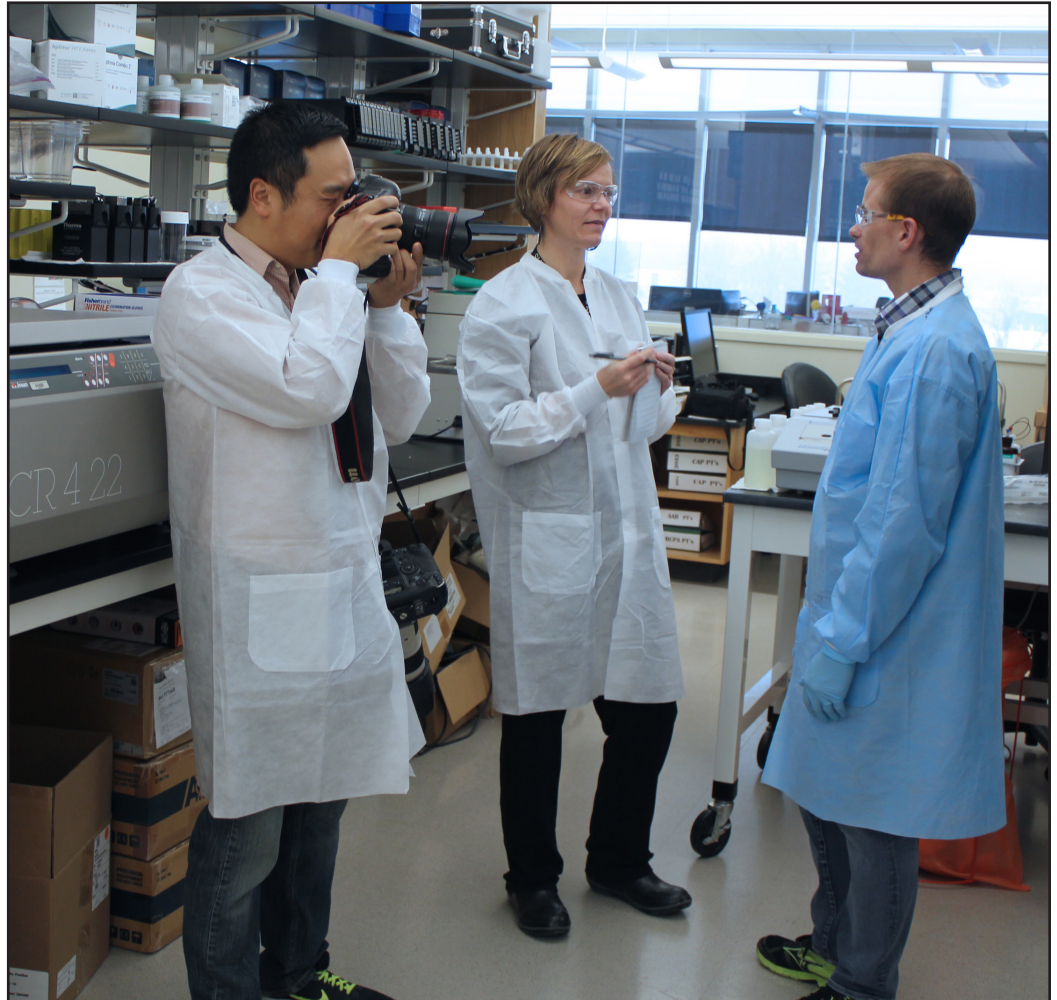
STRATEGIC COMMUNICATIONS

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The Office of Strategic Communications guides the flow of information from SHL to the public, news media and public health partners. It tells the SHL story through publications, outreach materials, website content, social media and external relationships.

Strategic Communications assists staff with presentations and papers by editing and preparing documents and posters.

The office shares the news of Iowa's state public health laboratory with local, state and national media; environmental and public health partners; educators; and the general public. Routine work consists of maintaining the website, and developing the *Lab Link* monthly newsletter, annual reports and press releases. The office also provides consultation and crisis communications during environmental and public health emergencies by managing clear and open communication.



Erin Jordan, reporter for The Gazette, interviews Kris Eveland about testing for sexually transmitted diseases.

HIGHLIGHTS

- Created the Biosafety for Clinical Laboratories course for the Association of Public Health Laboratories.
- Increased media coverage from 40 articles and broadcast stories in fiscal year 2017 to 113 in fiscal year 2018.
- Developed a promotional display for conferences and public events.
- Presented “Early History of the State Hygienic Laboratory” to the Centerdale Woman’s Club and the English Valleys History Center.
- Created a branding campaign, which included handouts, fact sheets, postcards, banners and magnets, for a state-wide private well water quality initiative and the Grants-to-Counties Program.
- Launched a Research web page and “Inside the State Hygienic Laboratory” brochure.

DISEASE CONTROL DIVISION

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The Disease Control Division (DCD) protects the citizens of Iowa by providing reference and diagnostic testing services for communicable diseases of public health significance. DCD testing supports numerous state and federal surveillance programs for antimicrobial resistance, health care acquired infections, respiratory pathogens, enteric pathogens and sexually transmitted diseases. DCD also performs newborn screening for genetic disorders and maternal screening for fetal development.

DCD staff actively participate in epidemiologic investigations of food-borne and other infectious disease outbreaks, provide consultation for interpretation and use of laboratory tests, and quickly respond to emergencies such as bioterror incidents, natural disasters and disease outbreaks.

BLOOD LEAD

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The Blood Lead section reduced the percentage of specimens rejected due to poor collection by 25 percent.

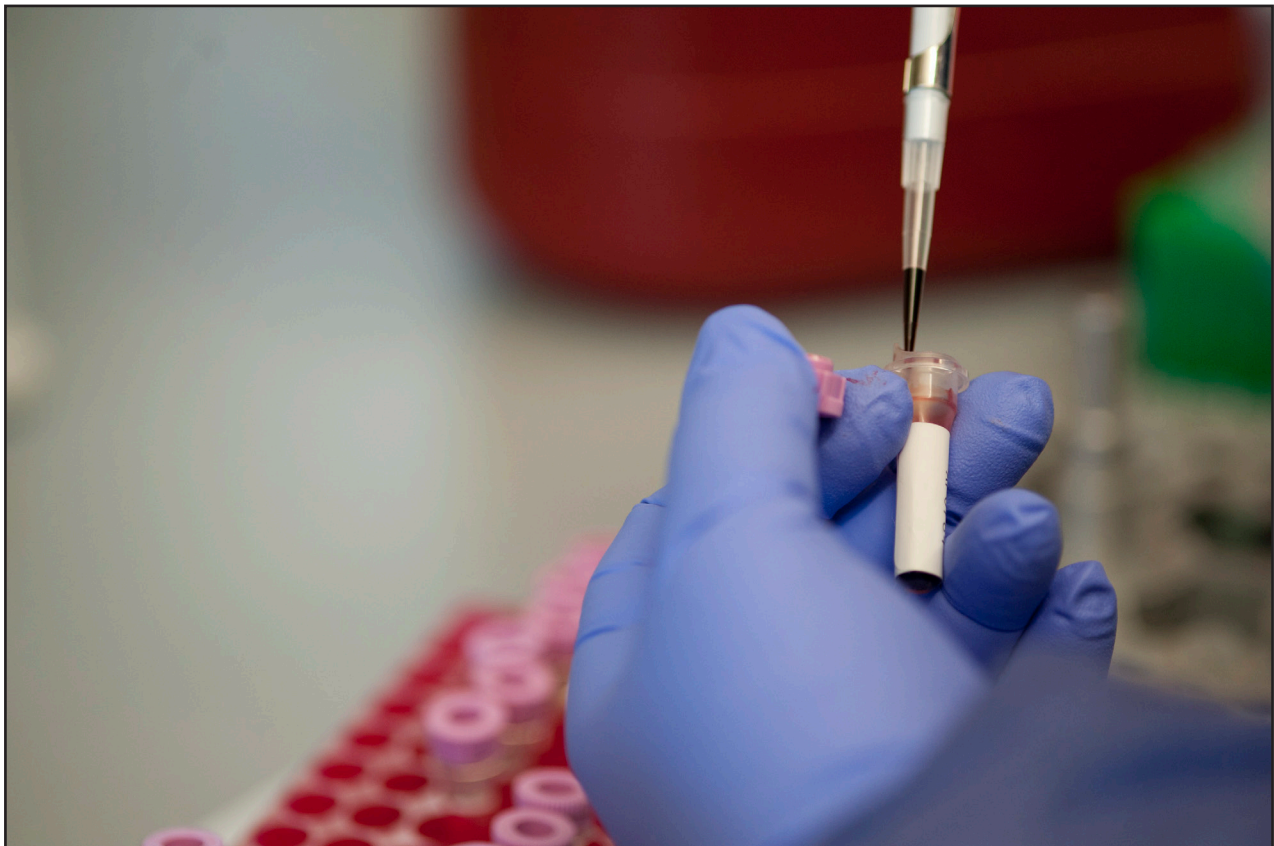
The SHL is the central testing laboratory for Iowa Department of Public Health's Childhood Lead Poisoning Prevention Program. As such, the Blood Lead section tests for the presence of lead in humans, and is the state's reference laboratory for confirmation of all capillary lead screening results.

The primary instrument used to screen blood specimens is a graphite furnace atomic absorption spectrometer. The Hygienic Laboratory also has the capability of using more sensitive multi-elemental techniques such as inductively coupled plasma mass spectrometry to detect low levels of lead and other potentially toxic metals such as cadmium, arsenic and mercury from the same blood specimen. Results from these instruments are analyzed by laboratory scientists to confirm the level of lead from venous blood specimens.

Point-of-care testing allows health care providers to test blood for levels of lead. However, because of the significant public health threat from lead poisoning, SHL maintains

the capability to provide both screening and confirmatory testing for IDPH. This capability was advantageous following the alert issued by the CDC and FDA in May 2017 regarding inaccuracies with certain point-of-care tests. The technique was susceptible to interferences produced by the compounds in the rubber stoppers of tubes used to collect venous blood. SHL instruments use different technology that was not affected by those interferences and, therefore, the laboratory could continue to provide reliable blood lead testing data.

TOTAL TESTS – More than 6,800



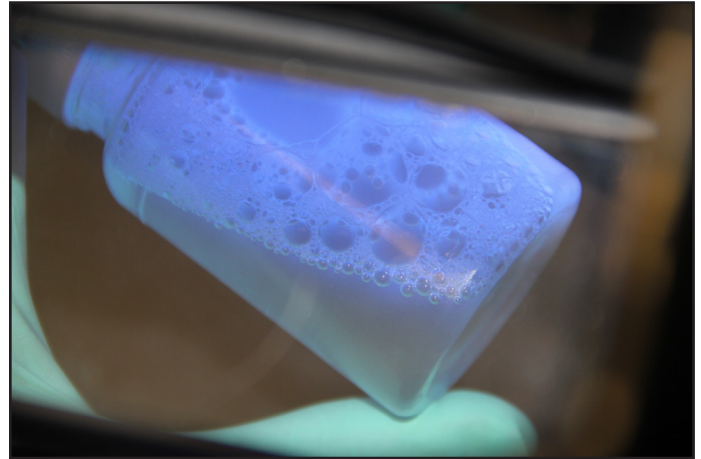
ENVIRONMENTAL MICROBIOLOGY

NANCY HALL: nancy-hall@uiowa.edu

A rapid response to a multi-state outbreak of *Salmonella* Typhimurium in chicken salad helped limit the spread of the foodborne illness.

The analytic services of the Environmental Microbiology section detect potentially harmful microorganisms in many environmental matrices, including food and water. Such analyses are used in outbreak investigations to pinpoint the source of contamination and to assess the environmental impact from exposure to microbial contaminants. Culture confirmation of microorganisms is critical to perform DNA fingerprinting on food, environmental samples and clinical stool isolates to evaluate the scope of the local or national outbreak as part of remediation efforts.

Laboratory testing also supports statewide water surveillance programs to assess the overall safety of public and private drinking water supplies, surface waters (lakes and ponds), and recreational waters (pools and spas). Pathogen analyses of water, food and environmental surface samples are expanding with emphasis on *Cryptosporidium*, *Legionella*, *Salmonella* and *Listeria monocytogenes*.



Drinking water fluoresces during the testing process, confirming the presence of *E.coli*.

TOP TESTS

1. Safe Drinking Water Act total coliform bacteria
2. Private well coliform bacteria
3. Private well nitrate
4. Surface water *E.coli*
5. Swimming pool total coliform bacteria

Total tests – 41,249

HIGHLIGHTS

- During the first week of February 2018, SHL laboratory staff observed a dramatic increase in the number of stools submitted for *Salmonella*. All isolates were the same serotype. IDPH epidemiologists identified chicken salad sold by a Midwest grocery store chain as the potential cause of the outbreak. Working with public health partners, 13 suspect chicken salad samples from throughout Iowa were collected and delivered to SHL for immediate testing. Within three days, Cathy Lord, environmental microbiologist, had identified *Salmonella* Typhimurium from the chicken salad. Using DNA fingerprinting technology and whole genome DNA sequencing, the *Salmonella* isolate from the chicken salad was matched to the clinical isolates. This established a direct link between the chicken salad and the outbreak, which supported consumer advisories about this product made by SHL's public health partners.
- Another emerging infectious disease area for the section was surveillance, research and education for *Legionella* species in water samples. Due to the new Center for Medicare & Medicaid Services requirements to reduce *Legionella* risk in health care facilities, Environmental Microbiology tested nearly a thousand water samples for this pathogen. Nancy Hall presented three lectures focusing on SHL's *Legionella* testing program and water management. As a continuation of the CDC Enhanced Laboratory Capacity Advanced Molecular Detection grant, whole genome sequencing research was performed on cultures isolated over the last five years to better understand the diversity of *Legionella* occurring in hospital water.

MATERNAL SCREENING

MICHELLE SEXTON: michelle-sexton@uiowa.edu

Successfully completed transition into new laboratory information system.

The purpose of maternal serum screening is to identify pregnant women at increased risk of having a developing fetus with Down syndrome, Trisomy 18 or an open neural tube defect, as well as provide patients and health care providers with information about their clients' pregnancies. The Iowa Maternal Screening Program consists of lab results generated from SHL as well as follow-up guidance by genetic counselors and OB/GYN nursing staff at the University of Iowa Hospital and Clinics for any patient generating an abnormal screening risk.

Detection rates vary depending on the screening test chosen by the provider. Integrated screening combines testing results from two samples collected in the first and the second trimester, and has the highest detection rate for pregnancies at risk if a Nuchal Translucency (NT)-certified sonographer provides an NT measurement. This screening test may be performed without an NT measurement at a slightly lower detection rate. By offering both options, it enables patients without access to an NT-certified sonographer to obtain an integrated screen.

TOP TESTS

1. Quad Screen
2. Integrated serum screen
3. AFP only – serum
4. First trimester only
5. AFP only – amniotic fluid

Total tests – 11,095

Total maternal screening risks generated – 8,070

HIGHLIGHTS

- Successfully completed the first full year using the OpenELIS laboratory information system.
- Continued working with providers to clarify what patient information is required to produce a valid pregnancy screening risk. This involved several factors, from education via phone calls to simplifying the test request form.



Maternal Screening lab scientists (from left) Barb Shirazi, Michelle Sexton and Karen Ciesielski

MICROBIOLOGY

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Tested more than 200 isolates in response to an outbreak of *Salmonella* in chicken salad.

Microbiology is the study of microorganisms that are, or may be, the cause of illnesses in humans. Specialized testing is performed in several areas: bacteriology, parasitology, mycobacteriology (tuberculosis) and mycology (fungi).

The Microbiology section is responsible for testing that supports several Centers for Disease Control and Prevention surveillance programs. As a member of the CDC's Antibiotic Resistance Laboratory Network, the Microbiology section works to address the emerging threat of antibiotic resistance. Microbiology works with the Iowa Department of Public Health (IDPH) to facilitate colonization screening for outbreaks related to Carbapenem-resistant Enterobacteriaceae (CRE) in health care and long-term care facilities. The section also performs confirmation and reporting of all suspected isolates of CRE found in the state.

Microbiology performs whole genome sequencing and pulsed-field gel electrophoresis of *Salmonella*, *Shigella*, *E.coli* and *Listeria* in support of CDC's PulseNet program. PulseNet is a national laboratory network that links cases of foodborne illnesses to identify outbreaks. In 2018, the Hygienic Laboratory and IDPH responded to an outbreak of *Salmonella* Typhimurium in chicken salad. Scientists in the Microbiology section tested more than 200 isolates of *Salmonella* in response to this outbreak.

The Microbiology section supports IDPH, all county health agencies and hospitals throughout the state by isolating and identifying pathogens of public health significance. The section responded to several multi-state outbreaks in parasitology. Specialized testing is also performed in the areas of mycobacteriology, mycology and bioterrorism. Selected Microbiology staff participate in the CDC Laboratory Response Network, which provides rapid response to biological threat agents and works closely with clinical laboratories to rule out suspected agents of bioterrorism.

HIGHLIGHTS

- **Von Stein D, Kline GM, Tranel AM, Oni KO, Hall N, Moet G, Aldous WK, Jepson RT.** Iowa's rapid response to a *Salmonella* Braenderup outbreak in the age of culture-independent diagnostic testing and whole-genome sequencing. Association of Public Health Laboratories Integrated Foodborne Outbreak Response and Management Conference (InFORM), Garden Grove, CA (Nov. 6-9, 2017). Poster.
- **Jepson, Ryan.** Tracking and Data Management of WGS and CIDTs: Sharing Best Practices. Association of Public Health Laboratories Integrated Foodborne Outbreak Response and Management Conference (InFORM), Garden Grove, CA (Nov. 6-9, 2017). Panelist.
- **Jepson, Ryan.** Antibiotic Resistance Mechanisms and Laboratory Detection. State Infection Control meeting, Des Moines, IA (May 2018). Presentation.

TOP TESTS

1. Mycobacteria testing
2. Parasitology
3. Enteric culture and serotyping
4. PulseNet PFGE and whole genome sequencing
5. Reference bacteriology/antibiotic resistance testing

TOTAL TESTS – 31,199

Computer-generated image of *Shigella*



MOLECULAR DIAGNOSTICS AND VIROLOGY

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Molecular Diagnostics and Virology validated and began PCR-based testing for the measles virus to help partners rapidly respond to potential cases.

Molecular testing techniques – primarily polymerase chain reaction (PCR) and next generation sequencing (NGS) – have significantly increased the overall sensitivity and specificity of detection and characterization of bacteria and viruses that cause disease. The Molecular Diagnostics and Virology section is heavily involved in supporting many molecular research and development projects, including the development of new PCR assays, and rapidly evolving NGS methods and associated bioinformatics.

The section works in close partnership with the Iowa Department of Public Health to target diseases of public health significance, which are highly communicable diseases that require intervention to reduce or stop their spread. Among these are legionellosis, viral meningitis, mumps, herpes and chicken pox.

The section also tests specimens related to disease outbreaks, such as whooping cough (pertussis) and norovirus, the primary cause of gastroenteritis outbreaks in Iowa. The Hygienic Lab is the only lab in the state that performs confirmatory norovirus tests. Identification of

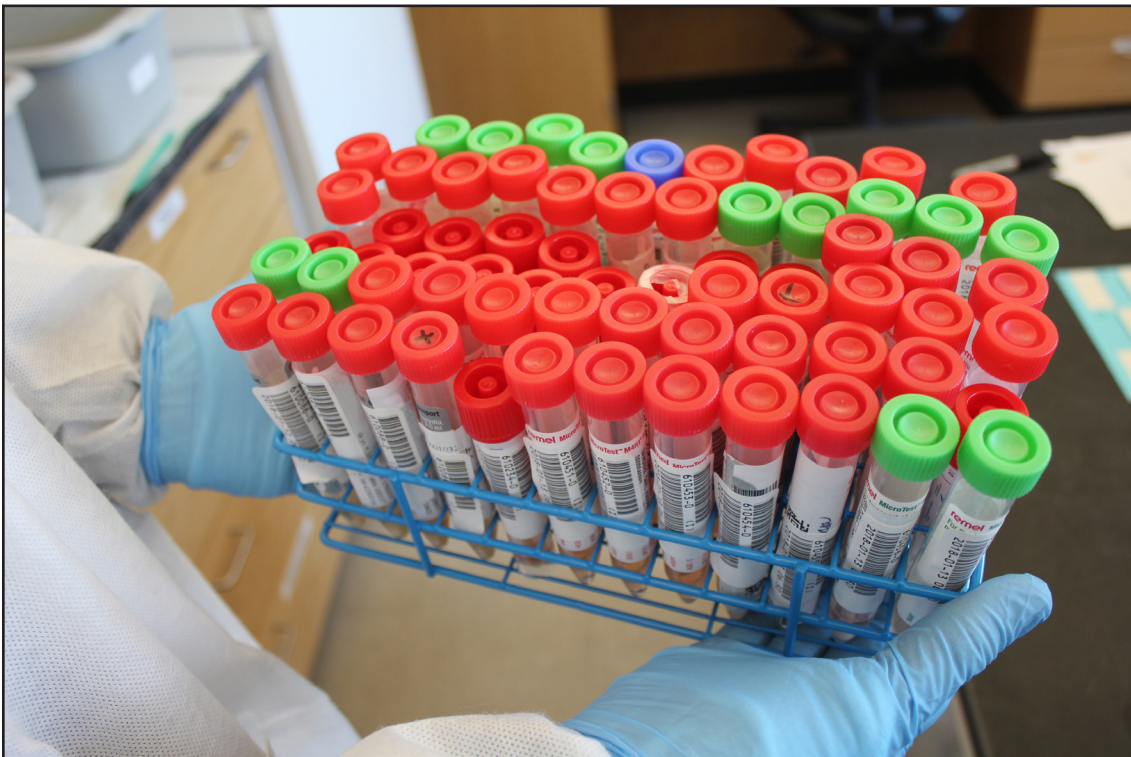
these pathogens allows state outbreak investigators to target remediation and prevention strategies.

Testing is also performed in support of various surveillance programs in partnership with the Centers for Disease Control, the Association of Public Health Laboratories, IDPH, Iowa State University and local public health departments.

- Viral respiratory disease surveillance informs the medical community of when and where influenza is circulating in the state, and if strains match the current vaccine.
- Sexually transmitted disease surveillance provides testing for the diagnosis of chlamydia and gonorrhea infections, ensuring patients receive proper treatment to prevent further spread of infection.
- Arbovirus surveillance tests mosquitoes and humans for West Nile virus, and alerts public health officials when mosquito-borne illnesses are circulating, allowing them to implement methods of infection prevention. This year, a record number of mosquitoes were tested by PCR at SHL for West Nile virus to determine if the

mosquito types known to transmit Zika virus were present in the state.

- PCR testing for *Cryptosporidium* and *Cyclospora* surveillance in various food items is conducted in cooperation with SHL's Environmental Microbiology section. Additionally, the section supports molecular testing for the Food Emergency Response Network (FERN).



Vials containing specimens for influenza testing

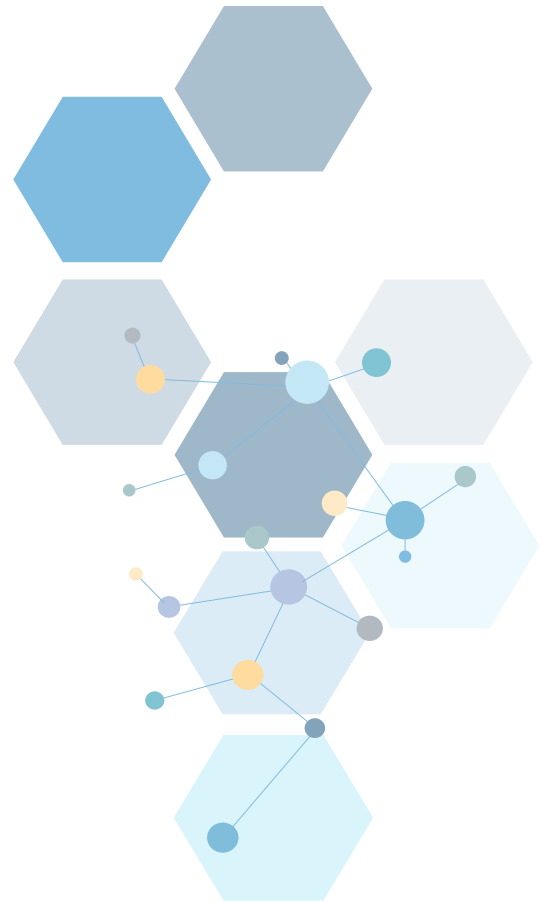
TOP TESTS

1. Chlamydia and gonorrhea
2. Influenza virus
3. Mumps virus
4. Trioplex for Zika, dengue and chikungunya virus
5. Norovirus

Total tests – 35,993

HIGHLIGHTS

- The section validated and began PCR-based testing for the measles virus, primarily used to rule out or diagnose acute infection. Having this PCR test performed at SHL will help SHL partners at IDPH more rapidly respond and prevent further spread in the event of a positive measles case or outbreak.
- Virology validated the use of a new automated instrument for chlamydia and gonorrhea screening as part of a pilot project for IDPH to screen for *Trichomonas vaginalis* among women living with HIV. This greatly reduces the amount of hands-on technician time, the chance for human technical error and the overall resource demand for this high volume testing.
- SHL began newborn screening testing for the state of Alaska on June 30, 2018. In collaboration with SHL's Newborn Screening section, the Molecular section validated a genotyping method for CPT1a, which is used to rule out or further assess mutations that occur in a portion of the Alaskan population. CPT1a mutations can result in a buildup of fatty acids that can damage the liver, heart and brain. Genotyping status is used by the Alaska Department of Health to provide educational counseling on the potential health impacts of the mutation.
- The section implemented a new FDA-validated PCR assay for Herpes Simplex Virus (HSV) types 1+2 and Varicella-Zoster Virus (VZV). This new assay greatly improves the turnaround time and increases the detection of VZV over the prior method, which used shell vial culture and direct fluorescent antibody. This will help clinicians make a more accurate diagnosis of cutaneous and mucocutaneous lesions of viral etiology.



NEWBORN SCREENING

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The Iowa Newborn Screening Program was selected by the Alaska Department of Health to provide newborn bloodspot testing and short term follow-up services for the state of Alaska.

The Iowa Newborn Screening Program identifies infants at risk for more than 49 inherited diseases by testing drops of blood obtained from a simple heel stick shortly after birth. Most newborns with an inherited condition show no obvious signs of disease. However, with special tests, the Iowa Newborn Screening Program can identify an infant who may be at risk, and alert the doctor and caregivers of the need for immediate, sometimes critical, medical treatment.

A nationally recognized leader in newborn screening, the Iowa program is administered by the Iowa Department of Public Health, which partners with the State Hygienic Laboratory and the University of Iowa Stead Family Children's Hospital.

SHL provides newborn screening for North Dakota, South Dakota and, beginning on June 30, 2018, for the state of Alaska. One of the key reasons the Alaska Department of Health selected Iowa is the 365-day a year operation of the laboratory, considered key to minimizing possible adverse birth outcomes for Alaska newborns.

SCREENING TOTALS

Iowa	323,489
North Dakota	104,102
South Dakota	108,217
TOTAL	535,808

SPECIMENS RECEIVED

Iowa	40,523
North Dakota	13,042
South Dakota	13,572
TOTAL	67,137

HIGHLIGHTS

- Work continued for offering an expanded Cystic Fibrosis (CF) mutation panel to be used as a second tier method for CF newborn screening. A comprehensive data review was done to identify CF variant mutations and their frequency. With this information, SHL was able to identify a more appropriate variant panel for our population. We continued our technical efforts in validating a new CF genotyping test in anticipation of placing the expanded panel in routine use in fiscal year 2019.
- Partnered with the Alaska Department of Health in preparation for conducting newborn screening bloodspot testing services for the state. Newborn screening staff began work in January 2018 – in collaboration with Alaska's newborn screening coordinator – to address the many tasks for transitioning the testing and establishing a contract for laboratory and medical follow-up services.
- Continued research collaboration on developing models predictive of gestational age using newborn screening biomarkers with Kelli Ryckman, associate professor in the University of Iowa Department of Epidemiology. SHL involvement in this project included testing approximately 2,000 research blood specimens from Africa and India for more than 70 newborn screening biomarkers.



SEROLOGY

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Testing for measles, rubella, Zika and other illnesses was automated with the addition of new equipment.

Serologic testing is used to diagnose certain acute, recent or chronic infectious diseases by detecting antigens or antibodies in the blood. In some cases, when the suspected etiologic agent is impossible, difficult or dangerous to grow in cultures in a routine diagnostic laboratory, serology is the safest, most practical testing method. Monitoring antibody levels that the body produces in response to exposure is important in the medical care of the patient, as well as in stopping the spread of the disease.

Serology's most commonly performed assay helps diagnose latent tuberculosis infection, with more than half being performed on students from high-risk TB areas of the world who are attending Iowa's universities and colleges. Screening for latent TB infection is an admission requirement to prevent the potential spread of the disease that could occur as international students join the campus population. The acquisition of a new instrument, the Dynex DSX, increased the daily capacity for testing TB, allowing the student testing to occur over a shorter time period. This decreases the chance of a student with a positive test from spreading the disease because of a delay in testing.

Measles and mumps exposures, as well as mosquito- and tick-borne diseases, are some of the diseases commonly requested for testing in support of epidemiological investigations performed by the Iowa Department of Public Health.



Molly Bradshaw prepares to analyze clinical specimens for latent tuberculosis testing.

HIGHLIGHTS

- Successfully implemented QuantiFERON TB Gold on to an automated platform.
- Updated instrumentation currently used to perform ZIKA and West Nile virus testing through grant funding by CDC. Future intentions are to automate these tests also.
- Validated the new QuantiFERON TB Gold Plus test and began using it for testing in June. This test uses four collection tubes instead of three, with the addition of another TB antigen tube. Having two antigen tubes looking for different cell types allows capture of a broader picture of an individual's immune response to TB infection.

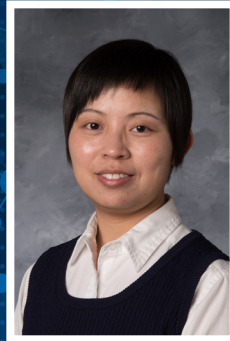
TOP TESTS

1. QuantiFERON-TB Gold – 3,550
2. Syphilis by VDRL – 2,504
3. Syphilis by TPPA – 879
4. Hepatitis B Surface Antigen – 563
5. Hepatitis B Surface Antibody – 522

Total tests – 15,621

ENVIRONMENTAL HEALTH DIVISION

SUSIE DAI, Director, Environmental Health Division
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The Environmental Health Division routinely monitors private and public drinking water, water from private wells, streams and lakes, wastewater, air, soil and food for contaminants of potential environmental and public health concern. It also responds to environmental and manmade emergencies – such as compromised water supplies due to chemical spills and flooding – with testing needed to protect public health. Services include testing samples submitted by the general public, local health departments and state agencies.

AMBIENT AIR QUALITY

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Outdoor air quality data was collected from more than 78 monitors in 14 Iowa counties.

Ambient Air Quality provides technical expertise, equipment calibration and maintenance for monitors that sample and analyze Iowa's ambient (outdoor) air quality. These monitors – along with monitors maintained by public health departments in Linn and Polk counties – form a surveillance network covering all major population and industrial centers in Iowa.

The state of Iowa requires ambient air monitoring as part of the Clean Air Act. The Hygienic Lab's Ambient Air section fulfills this requirement through a contract with the Iowa Department of Natural Resources.

Data from more than 78 monitors at 21 sites in 14 Iowa counties is available in the Ambient Air section of the Hygienic Lab's website. Real-time data is highlighted and provides concentration information about many pollutants in Iowa's air. Many of these monitors have been active for several decades.

Data collected by Ambient Air Quality staff is submitted to the Iowa DNR and EPA and used for research and enforcement. These are essential for Iowa to maintain ambient air that is among the cleanest in the nation.

Environmental analyst Allison Smalley checks the temperature probe on an air quality monitor in Waterloo.



INDUSTRIAL HYGIENE

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Nearly 2,000 tests were performed to help limit exposure to harmful substances.

The Industrial Hygiene program performs occupational health testing for the Bureau of Labor to support the programs of Iowa Department of Workforce Development and the Iowa Occupational Safety and Health Administration. Testing for these programs is performed in both the Ankeny and Coralville labs, and consists of testing air filters for inorganic and organic chemicals to assess occupational exposures to chemicals and fumes in the workplace.

SHL also tests for asbestos, a group of similar minerals with

separable, long, thin fibers. It is a natural mineral fiber that was used in products primarily because of its fire-retardant capability and strength. Asbestos has long been suspected as a health threat to humans, because the fibers can be inhaled and are difficult to remove from the lungs.

Asbestos testing is performed for businesses, state agencies and individuals. Materials that are frequently tested for asbestos include roofing, flooring and other items used in construction.



Asbestos fibers in building materials

TOP TESTS

1. Bulk asbestos in building materials
2. Industrial Hygiene Metals, NIOSH 7300
3. Various organic solvents in air by gas chromatography
4. Particulates (Respirable and Total Dust) in air
5. Various organic solvents in air by liquid chromatography

Total tests – 1,890

INORGANIC CHEMISTRY

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Inorganic Chemistry analyzed sand and water for bacteria as part of an Iowa DNR project.

Inorganic elements are minerals and metals found in the environment, some of which are harmful to human and animal health, even with minimal exposure. Some inorganic compounds occur naturally in the environment, such as metals found in soil and rock, while others are present due to human activities, such as crop fertilization or the use of lead in paint prior to 1978. Detection of these elements is important because mitigation techniques can be implemented to reduce potentially dangerous exposure.

Testing is conducted for state agencies, public water supplies, county public health departments, businesses and private citizens. The Inorganic Chemistry section can determine the presence of inorganic elements in air, groundwater, drinking water, surface water, wastewater, soil, sludge, vegetation and food. Tests conducted on these matrices can determine the presence of arsenic, cadmium, mercury, lead and many other metals in the environment.

Samples from public and private (well) water supplies are analyzed for levels of nitrate, nitrite, total coliform and *E. coli* bacteria. Testing for lead in dust, paint, soil, pottery and food products is performed to help identify sources of lead exposure.

Inorganic Chemistry processes samples with short holding times (within 48 hours of collection) to determine the presence and levels of orthophosphate, nitrite and nitrate. Determination of levels of oil and grease in waste streams is performed at the Coralville laboratory.

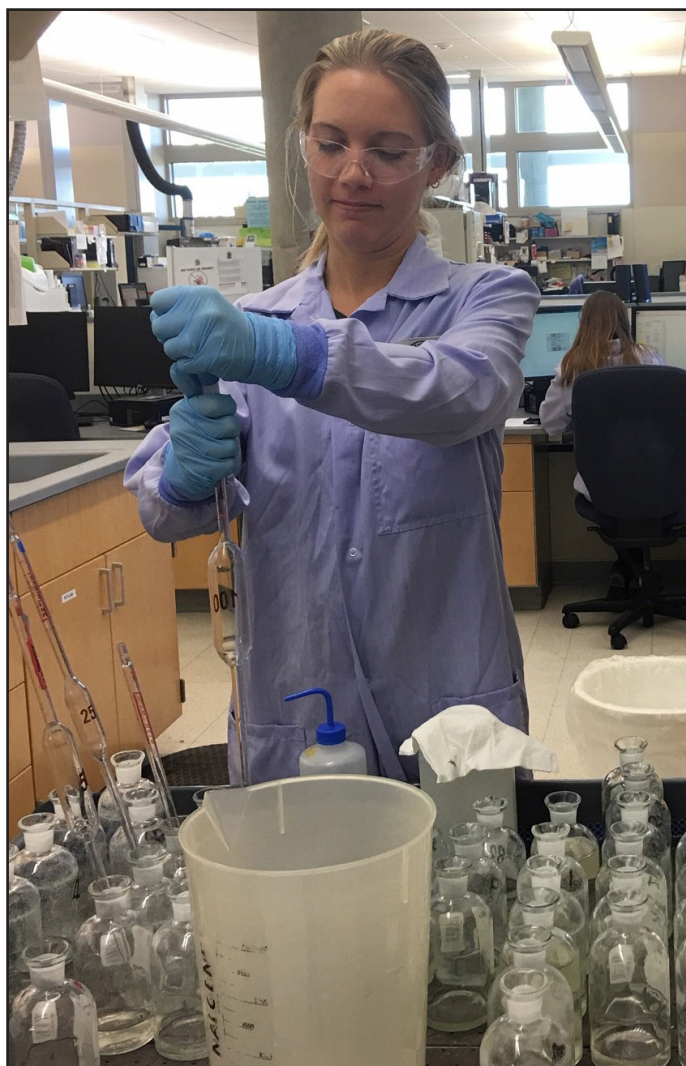
TOP TESTS

1. Total Suspended Solids
2. Ammonia
3. Metals EPA 200.8
4. Total Phosphorus
5. Nitrate and Nitrite

Total tests – 52,000

HIGHLIGHTS

- Analyzed private wells during the fall 2017 well survey for nitrate, nitrite, total coliform and *E. coli* bacteria.
- Continued working with IDNR on analyzing sand and water for bacteria analysis.



Angela Johnson pipettes water for biochemical oxygen demand (BOD) analysis.

LABORATORY CERTIFICATION PROGRAM

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The Laboratory Certification program assisted in reviewing the 184 laboratories in the Iowa DNR program to ensure that reliable analytical data for the state's wastewater, drinking water and solid waste programs is provided to minimize threats to the environment.

Public water providers in the United States are required to monitor their drinking water to determine if consumers are adequately protected from microbiological, chemical and radiochemical contaminants. Similarly, wastewater treatment facilities perform analyses to assure that the wastewater is properly treated to protect the environment from bacteria, pathogens and other pollutants.

The Hygienic Laboratory provides laboratory certification assessments and management for the Iowa Department of Natural Resources. These were developed over the past 30 years to provide a comprehensive list of testing parameters and fields of testing for laboratory certification.

A laboratory is certified to perform a specific method for a specific analyte or analyte group. The program also provides the opportunity for a testing laboratory to become certified for a specific analyte group across multiple environmental programs. For example, a lab may acquire certification for

inorganic chemicals (IOCs) within the wastewater, drinking water and contaminated sites programs.

There are 184 laboratories certified in 2018. These include municipal and regional water plants, water treatment facilities and commercial laboratories. Approximately 150 laboratories perform only wastewater testing. The remainder test for drinking water, or a combination of drinking water, wastewater and solid waste. Commercial laboratories include those that are located both in and outside of the state that perform work in Iowa.

Certification in Iowa is on a two-year cycle with most laboratories receiving an onsite inspection once during that two-year period. Some laboratories, especially out-of-state laboratories that are certified in their home state, can be certified for Iowa based on reciprocity with their state's certification or accreditation in the National Environmental Laboratory Accreditation Program. Through reciprocity, a laboratory may not require an onsite inspection.



Wastewater treatment plant

LAKESIDE LABORATORY

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A study was conducted on three sub-watersheds of the Iowa Lakeside Lab campus during the summer of 2018.

The Water Chemistry Laboratory at the Iowa Lakeside Laboratory – Regents Resource Center is an SHL satellite environmental laboratory located in Milford, Iowa. It conducts analytical testing on both public and private drinking water, groundwater, surface water and wastewater. The lab also assists local water testing facilities.

Lakeside’s newest building is the Waitt Lab, a gift of the Friends of Lakeside Lab. Opened in 1998, it contains the Bovbjerg Water Chemistry Laboratory, two classrooms, several offices and Andrea’s Atrium, which is used for receptions and gatherings.

Staff provides educational and outreach services for local students and citizens, as well as classes and laboratory experiences for college students, interns and teachers.



Dennis Heimdal demonstrates how zooplankton are collected to assess water quality.

HIGHLIGHTS

- A study was conducted on three sub-watersheds of the Iowa Lakeside Lab campus during the summer of 2018. From June through early July, two area teachers collected water samples from the three watersheds and performed various field measurements and lab water quality analyses on the samples. Valuable data was collected during this time frame because the collections bracketed a period of heavy rainfall and flooding within the watersheds. Support for this study came from the State Hygienic Laboratory-Lakeside Laboratory and the Iowa STEM Program.
- A partnership with Iowa Lakes Community College was started for interns. Students from the Water Quality Analysis Program receive hands-on training at SHL Lakeside Laboratory throughout the course. This partnership allows students to gain knowledge in a real-world water quality testing facility.
- The Cooperative Lakes Area Monitoring Project completed its 20th year of sampling Dickinson County lakes. Volunteers for the program collected more than 200 samples, which were analyzed for nutrients, algae and water clarity. This is the longest running lake monitoring program in Iowa.
- Numerous outreach programs and presentations were conducted for area junior high and high schools, service clubs, lake association groups, and for college classes held at Lakeside Laboratory.

TOP TESTS

1. Total coliform/*E. coli* for drinking water
2. Total phosphorus in water
3. Total coliform for pools
4. Total Kjeldahl nitrogen in water
5. Nitrate + Nitrite as Nitrogen

Total tests – 5,900

LIMNOLOGY

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Limnologists based in Coralville and Ankeny collected and identified tens of thousands of fish and benthic macroinvertebrates and the measurement of more than 50 physical habitat parameters along approximately 850 stream transects.

Limnologists collect and analyze samples of surface water, wastewater and groundwater throughout Iowa. They examine the chemical and physical characteristics and biological organisms and processes of aquatic ecosystems. The data from this work is used to assess short- and long-term trends in water quality throughout the state.

The limnologists specialize in benthic macroinvertebrate and fish taxonomy. In partnership with the Iowa Department of Natural Resources, they have developed one of the top stream bioassessment programs in the United States. Their efforts have created comprehensive records of the benthic macroinvertebrate and fish communities in Iowa and the documentation of many species not previously recorded in the state.

TOP TESTS

1. Chlorophyll
2. Field pH
3. Field temperature
4. Field dissolved oxygen
5. Benthic macroinvertebrate collection and taxonomy

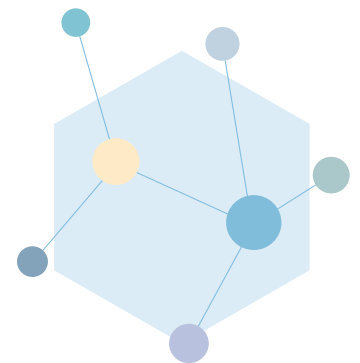
Total tests – 7,603

HIGHLIGHTS

- Performed 99 bioassessments in seven ecoregions across the state, which included collecting and identifying tens of thousands of fish and benthic macroinvertebrates and the measurement of more than 50 physical habitat parameters along approximately 850 stream transects.
- Monitored 61 stream sites across Iowa on a monthly basis for ambient water quality parameters that included nutrients, bacteria, metals, chlorophyll, solids, temperature, pH, dissolved oxygen and stream discharge.
- Performed several special stream and lake characterization studies and shared subject matter expertise with federal, state and local agencies to assist their water quality analysis of rivers, streams, lakes and impoundments.
- Donated hundreds of hours to educate students in Iowa grade schools, high schools, colleges and universities about methods of water quality analysis (chemical, biological and physical) and the importance of being good stewards of natural resources. This included assisting with the development of a water monitoring curriculum implemented in several elementary schools in Iowa.
- Gave several presentations on wastewater collection techniques and analysis to wastewater treatment plant operators.



Samples collected by SHL Limnologists from various creeks throughout the state



ORGANIC CHEMISTRY

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SARAH MAY: sarah-may@uiowa.edu

Organic Chemistry continued to add emerging contaminants to its menu of tests while conducting research on exposure to personal care products and rolling out testing for EPA's Unregulated Contaminant Monitoring Rule 4.

Human activities often have a significant impact on the environment. Contaminants that infiltrate our natural resources can be detrimental to the health of both humans and animals. The Organic Chemistry section analyzes air, soil, water, vegetation and food to identify and measure potentially toxic organic compounds, such as disinfection byproducts, volatile organic compounds, plasticizers, pesticides, personal care products, pharmaceuticals and industrial chemicals.

Testing is conducted for state agencies, public water supplies, county public health departments, businesses and private citizens. Routine environmental monitoring is conducted to evaluate the ongoing health of Iowa's environment, while responsive testing is conducted to determine the risk of human and animal exposure in the event of environmental catastrophes.

Analysis for organic compounds is conducted using highly specialized methods and instrumentation to detect very

low levels of organic compounds. New testing methods are implemented as new threats emerge, such as the possible presence of hormones and steroids in drinking water.

Organic Chemistry sections of the lab include Gas Chromatography Analysis and Liquid Chromatography Analysis, so named for the technology used in the analyses of various samples to determine organic contaminants. A gas chromatograph is used to analyze relatively low molecular weight organic compounds that can be vaporized by heating, while a liquid chromatograph can detect extremely low levels of compounds that have a higher molecular weight and are not as easily vaporized.

HIGHLIGHTS

- Extended testing services under the Safe Drinking Water Act for public water supplies in the state of Iowa to accommodate new monitoring requirements for glyphosate and diquat herbicides.
- Completed qualification for participation in EPA's Unregulated Contaminant Monitoring Rule 4, and began testing for this three-year monitoring program.
- Collaborated with the University of Iowa Department of Dermatology in a study of the effectiveness of personal surgical masks in protecting workers from exposure to organic chemicals produced during dermatological procedures using certain laser techniques.
- Collaborated with the University of Iowa Department of Occupational and Environmental Health in evaluating, in vitro, if a consumer skin product containing Ammonia Oxidizing Bacteria can result in the production of nitrosamines due to the ammonia and urea content of perspiration.
- Participated in the Iowa Well Survey in conjunction with the Grants-to-Counties program to examine the extent of pesticide contamination and other contaminants in private wells.
- Performed 3,686 total sample preparation tests.

TOP TESTS

GAS CHROMATOGRAPHY

1. Haloacetic acids in water
2. Trihalomethanes in water
3. Volatile organic compounds in water and soil
4. Semivolatile organic compounds in water and soil
5. Acid herbicides in water

TOTAL TESTS – 4,419

LIQUID CHROMATOGRAPHY

1. Neonicotinoids in water
2. Carbonyls in air
3. Glyphosate in water
4. Diquat in water
5. Chloroacetanilides and degradates in water

TOTAL TESTS – 2,339

RADIOCHEMISTRY

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Radiochemistry's sample volume increased by 7 percent during fiscal year 18.

Radionuclides can be harmful to human health if inhaled or ingested. They are commonly present at low concentrations in geological formations, produced at low levels through interactions between the atmosphere and cosmic radiation, and are produced artificially through human activities, such as power generation, medical therapy and heavy industry.

The Radiochemistry section primarily performs analyses of water and soil to determine radioactivity concentrations, but also is capable of analyzing air, food, milk, urine and foliage. The section maintains preparedness for any radiation emergency response incidents.

TOP TESTS

1. Gross alpha radiation
2. Combined radium
3. Gamma Spectrometry
4. Tritium
5. Gross beta emitters

Total tests – 4,355

HIGHLIGHTS

- Continued to meet expected turnaround times despite a 7 percent increase in sample volume, including new high-complexity analyses.
- Performed extensive surveillance for radionuclides in food products as part of the Food Emergency Response Network.
- In collaboration with researchers at the University of Iowa, radiochemistry staff presented work at eight local and national meetings, including the Radiobioassay and Radiochemical Measurements Conference, Association of Public Health Laboratories annual meeting, the Iowa Governor's Conference on Public Health (IGCPH), and the Natural Resources Defense Council Workshop on TENORM in the Oil and Gas Industry. Staff received an award for best poster design at the IGCPH.
- Radiochemistry supervisor Dustin May was recognized as both a University of Iowa Dare to Discover scholar and a U.S. Nuclear Regulatory Commission Radiochemistry graduate fellow in relation to his graduate research performed at SHL.



Harmful blue-green algae (cyanobacteria) float on a pond at Northridge Park in Coralville, Iowa.

RADIOLOGICAL EMERGENCY RESPONSE TEAM

AMANDA HUGHES: amanda-hermann@uiowa.edu

The Radiological Emergency Response Team (RERT) section maintained the Hygienic Laboratory's preparedness to respond to radiological emergencies.

The RERT is part of Iowa's Radiological Emergency Response program. This group provides field monitoring, technical consultation and initial accident assessment in coordination with the Iowa Department of Public Health (IDPH).

The team also works with Iowa Homeland Security and the Emergency Management Division to prepare for the unlikely event of an act of terrorism or an accident at one of the four nuclear power plants in or near Iowa. The role of the Hygienic Laboratory's RERT is to evaluate the extent to which radioactive materials have been released from an incident.

Federal guidelines require emergency planning for areas within a 10-mile and a 50-mile radius of a nuclear power station.

RERT hosted an annual field team training and participated in five drills at the local nuclear energy sites. During one of the drills, the team was evaluated by the Federal Emergency Management Agency with outstanding results. They demonstrated the required knowledge necessary and displayed excellent teamwork.

The laboratory also provides the following services.

- Field surveillance and monitoring of radiation levels, including coordination of environmental sampling with state and federal agencies.
- Dose assessment in support of Iowa Department of Public Health programs.
- Laboratory analysis and support of environmental sampling and radiological monitoring activities during an emergency and post emergency.
- Maintenance and communication of data relating to radiation exposure and contamination.
- Technical expertise for local emergency response personnel for monitoring and decontamination of evacuees.



ADMINISTRATIVE AND FINANCE DIVISION

SARAH DRICKEN, Director, Administration and Finance Division
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The Administration and Finance Division supports the scientific testing areas of the laboratory. Responsibilities include distribution of sample collection supplies, sample receiving and accessioning, client services and outreach, purchasing, and fleet vehicle support.

The division oversees the laboratory's quality management system at all three laboratory sites to ensure accurate and reliable test results. This includes managing multiple accreditations and on-site inspections.

The division provides the laboratory's business management, including accounting and financial support, client billing, and grants and contracts management.

BUSINESS DEVELOPMENT

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The Business Development section processed 57 applications through the UI Division of Sponsored Programs, totaling more than \$8.3 million in awards.

Business Development coordinates pre- and post-award administrative functions for internal (University of Iowa) and external funding sources. These external sources include state agencies, federal agencies and various other public and private sources of funding.

State agency partners include the Iowa Department of Natural Resources, the Iowa Department of Public Health, the Iowa Department of Inspections and Appeals, and agencies in other states.

Federal and national partners include the Centers for Disease Control and Prevention, the Food and Drug Administration, the Environmental Protection Agency, the U.S. Department of Agriculture and the Association of Public Health Laboratories.

Client Outreach is part of Business Development. It carries out the Hygienic Laboratory's service, education and

research mission by increasing understanding and use of the state's public health and environmental laboratory system. Strategic planning, process improvement, market research and analysis, and customer feedback are key parts of this unit, which is a liaison between the laboratory and its clients.



CENTRAL SERVICES

KEVIN SINGLEMAN: kevin-singleman@uiowa.edu

Central Services sent an average of 1,940 sample kits to clients each month.

Located in Coralville and Ankeny, this section creates and distributes analytical test collection kits to clients throughout Iowa and other states. Staff also process incoming and outgoing packages and correspondence.

Central Services provides support for the entire laboratory by purchasing, tracking and distributing supplies necessary for laboratory testing. Team members are certified in Hazmat shipping requirements for select packages, and specially trained personnel perform necropsy work to assist with rabies testing.

The section also schedules the University of Iowa Fleet Service leased vehicles used by staff. On average, staff members travel approximately 150,000 miles per year to carry out the Hygienic Laboratory's mission.



CLIENT SERVICES

SHERRI MARINE: sherri-marine@uiowa.edu

The Client Services section consists of the services directly related to customer support and interaction. Each staff member has direct contact with Hygienic Laboratory clients. They provide the critical first impression and professionalism expected by businesses from all University of Iowa departments.

The section handles clinical and environmental needs for SHL. Staff that primarily oversee the environmental clients manage approximately 700 public water supply permits as well as working with wastewater facilities and handling numerous other requests. Staff provide quotes, kits, results and customer service to facilities on a daily basis, and use an automated system to send collection supplies and paperwork based on permit needs.



Staff primarily oversee clinical client requests, perform data entry, respond to customer service requests and serve as receptionist.

Because of the interaction with clients, the staff members must maintain a thorough knowledge about laboratory services and business operations.

CENTRAL ACCESSIONING

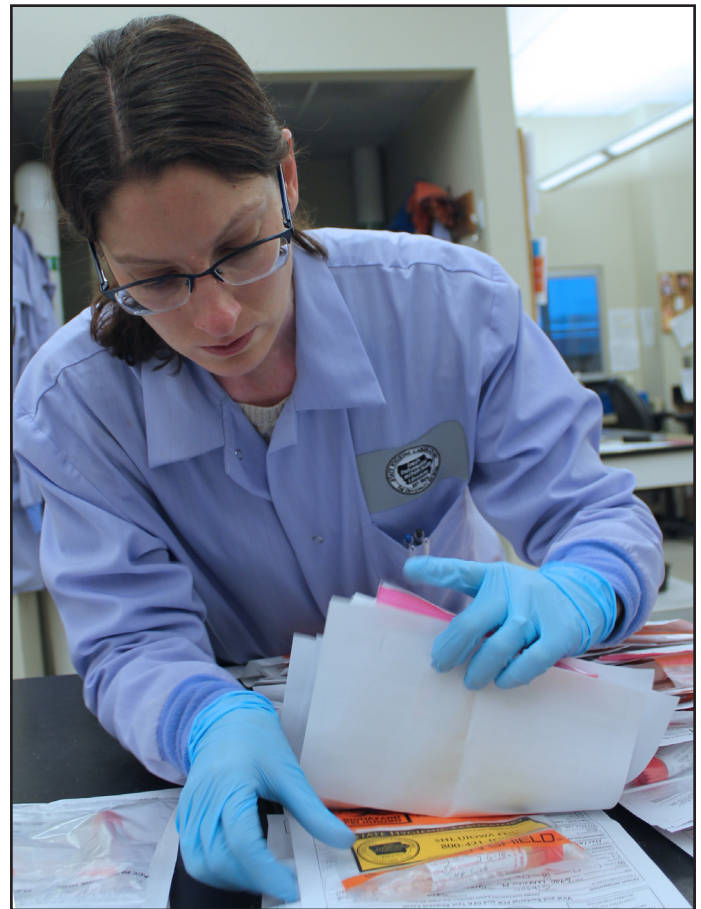
All clinical and environmental specimens sent or delivered to the Hygienic Lab are received and processed by Central Accessioning. This section tracks, receives, ships, stores, accessions, logs in and delivers these specimens to individual labs for testing.

Staff members are responsible for assuring specimens are received intact, with the proper paperwork (including chain

of custody documents), at the correct temperature, and within the required holding times.

The Glassware section cleans (and sterilizes if required) various glassware, instruments and equipment used throughout all SHL labs. These items are retrieved, cleaned, processed, sorted and delivered back to their respective labs. This sustainable approach ensures that glassware items are sterilized properly and ready to reuse. The total pieces of glassware cleaned daily may approach 2,000 to 3,000. Glassware personnel are also responsible for removing autoclaved waste from laboratory areas and the proper handling of this waste for removal.

The Media/Reagent Lab makes sterile media used primarily by the environmental microbiology and bacteriology laboratory sections. It supplies media for the tuberculosis, mycology and serology sections, as needed. The section also provides media for special projects, yearly workshops and outreach educational programs.



Laura Clark sorts specimens for influenza testing.

CLINICAL LABORATORY APPRAISAL PROGRAM (CLIA)

KRISTINE ROTZOLL: kristine-rotzoll@uiowa.edu

Under the federal Clinical Laboratory Improvement Amendments (CLIA) of 1988, any laboratory or facility performing laboratory testing of human specimens to provide information for the diagnosis, prevention or treatment of disease, or the assessment of health, is required to obtain a CLIA certificate and to meet certain requirements.

For more than 45 years, the Hygienic Laboratory, under contract with the Iowa Department of Inspections and Appeals, has provided personnel to conduct laboratory surveys. Since 2002, the Hygienic Lab also has been responsible for administrative oversight of the CLIA laboratory program and is the state agency representative for the Center for Medicare and Medicaid Services CLIA program.



HIGHLIGHTS

- Completed 168 laboratory surveys including: 16 initial surveys, three complaint surveys, six validation surveys and 143 recertification surveys.
- Performed 13 proficiency testing desk review surveys, for laboratories that have not met the proficiency testing performance requirements.
- Traveled a total of 26, 271 miles performing surveys throughout the entire state of Iowa.

FINANCIAL MANAGEMENT

CHRISTINE ANDERSON: christine-m-anderson@uiowa.edu

Financial Management processed more than 17,000 invoices.

The finance section is responsible for the management of the \$24 million State Hygienic Laboratory operation, including overseeing revenues and expenses to accomplish the objectives of the laboratory.

This accounting, billing, purchasing, financial analysis, and revenue- and expense-stream management section of the laboratory provides financial transaction support for more than 4,000 clients and distributes more than 17,000 invoices per year.



QUALITY SYSTEMS MANAGEMENT

MARK PENDERGAST: mark-pendergast@uiowa.edu
MARCIA VALBRACHT: marcia-valbracht@uiowa.edu

The Quality Management team modernized its system based on Quality System Essentials.

Quality Systems Management assures regulatory compliance and laboratory best practices using data to drive process improvement and achieve quality management objectives.

The essential focus of Quality Systems Management is to ensure the quality of SHL's scientific, consultative, training and research obligations. The unit plays a key role in meeting the needs of customers by continuously evaluating and improving processes, reducing waste, lowering costs, identifying and facilitating training opportunities, engaging staff and setting organization-wide direction.

The Quality System managers help coordinate and direct activities to meet customer and regulatory requirements, and improve effectiveness and efficiency on a continuous basis with input from the following:

- ISO/IEC 17025:2005 – The SHL Management Principal
- Clinical Laboratory Improvement Amendments (CLIA)
- Health Insurance Portability and Accountability Act (HIPAA)
- Environmental Protection Agency
- National Environmental Laboratory Accreditation Program (NELAP)
- Iowa Department of Natural Resources State Certification
- State Environmental Certification for Testing in Kansas, Nebraska, New Hampshire, North Carolina and Virginia
- American Industrial Hygiene Association (AIHA)
- Food and Drug Administration
- Food Emergency Response Network (FERN)

HIGHLIGHTS

- Validated and verified new testing processes using project management.
- Provided outreach and education by coauthoring the Quality Management Training Series on APHL's website.
- Maintaining Demonstrations of Capability for technical staff
- Maintaining Proficiency Testing
- Maintaining Internal Audit Program



YEAR AT A GLANCE



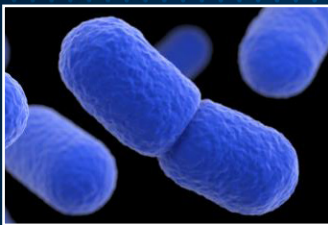
July

Project AWARE volunteers remove 28 tons of trash from the Cedar River.



August

Eleven interns and student employees join SHL for the summer.



September

SHL, FDA and Iowa Department of Inspections and Appeals evaluate a new *Listeria* test.



October

Emergency Preparedness responds to a white powder incident.



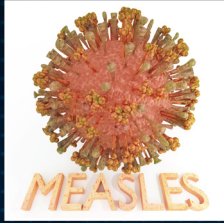
November

CDC warns consumers of contaminated raw milk and cheese.



December

Jennifer Elwood uses the online database MicrobeNet to help identify pathogens.



January

Four cases of measles are confirmed in Arkansas, Illinois and Indiana.



February

Flu-related deaths in Iowa triple from the same time last year.



March

SHL names Michael Pentella as director.



April

Iowa Newborn Screening Program gathers public input about screening.



May

More than 2,300 Iowa fifth graders and SHL volunteers meet for the Iowa Children's Water Festival.



June

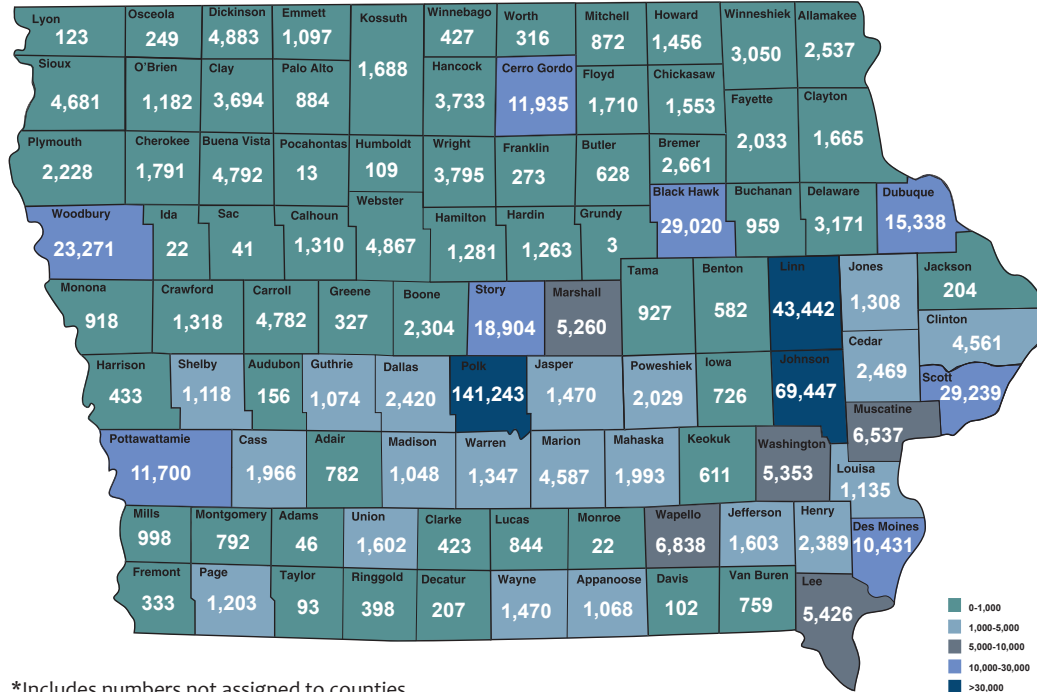
Coca-Cola North America funds a UI and SHL sustainability project.

SUMMARY OF TESTING FY2018

TOTAL TESTING

IOWA AND NATIONWIDE COMBINED
779,999 Analyses Performed
208,830 Samples Submitted

IOWA
557,371 Analyses Performed*
178,193 Samples Submitted



*Includes numbers not assigned to counties

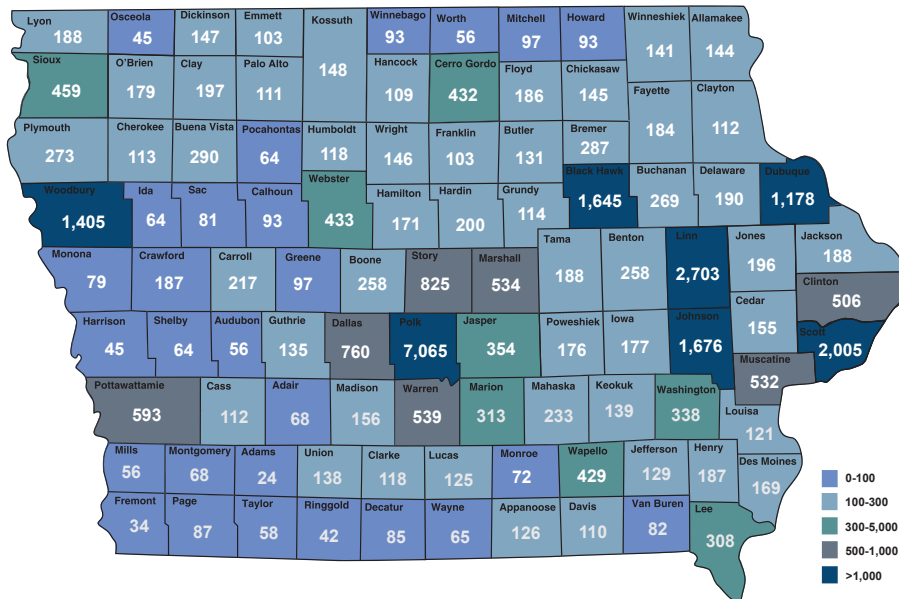
NEWBORN SCREENING

IOWA
323,489 Analyses Performed
40,523 Samples Submitted

NORTH DAKOTA
104,102 Analyses Performed
13,042 Samples Submitted

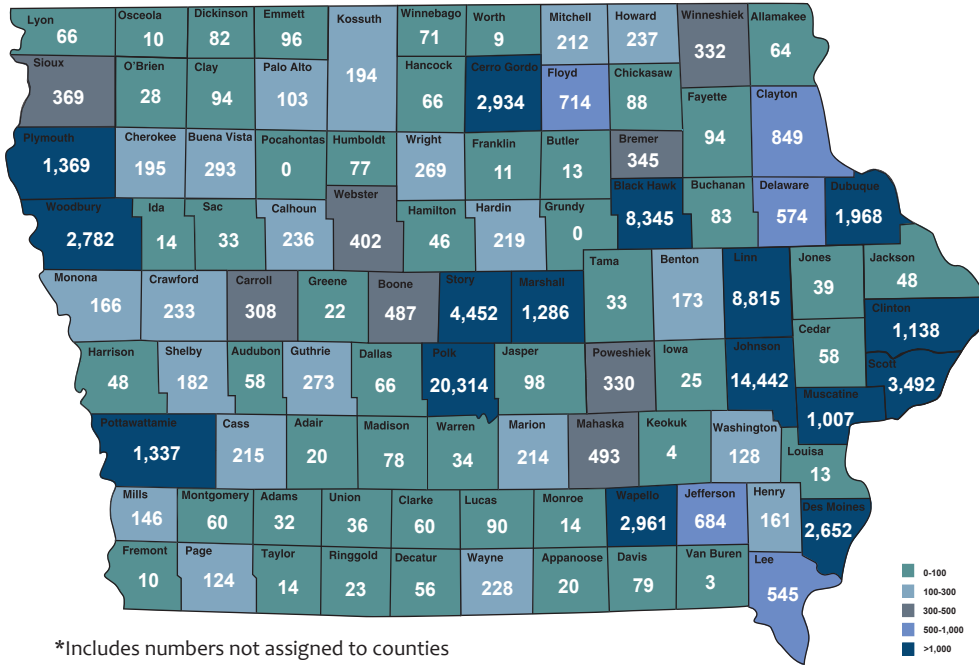
SOUTH DAKOTA
108,217 Analyses Performed
13,572 Samples Submitted

Babies Screened in Iowa FY2018 Based on Mother's Zip Code = 35,307



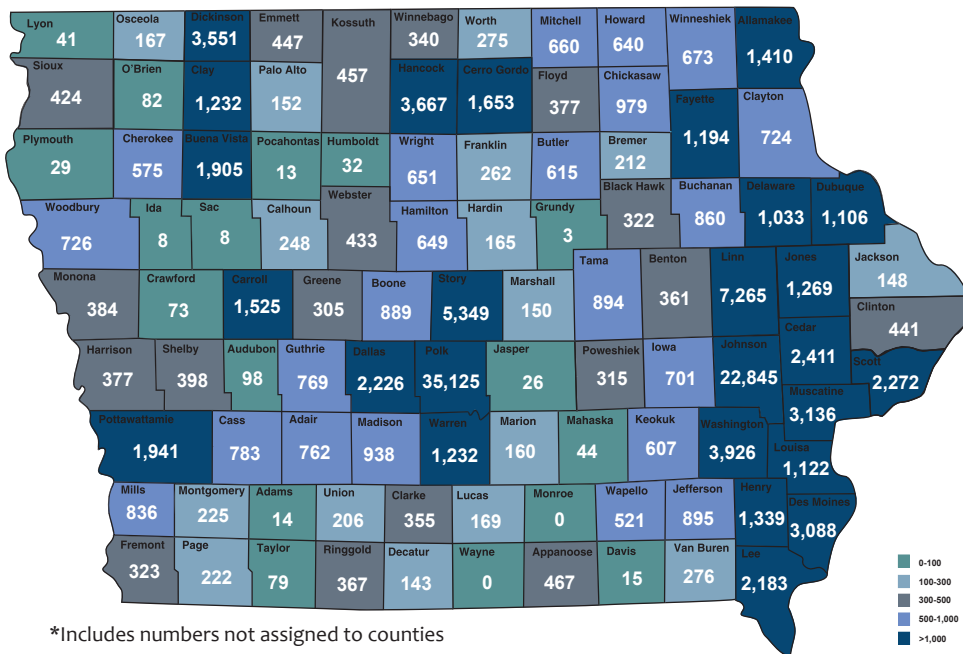
CLINICAL DISEASE TESTING

IOWA
94,123 Analyses Performed*
71,415 Samples Submitted



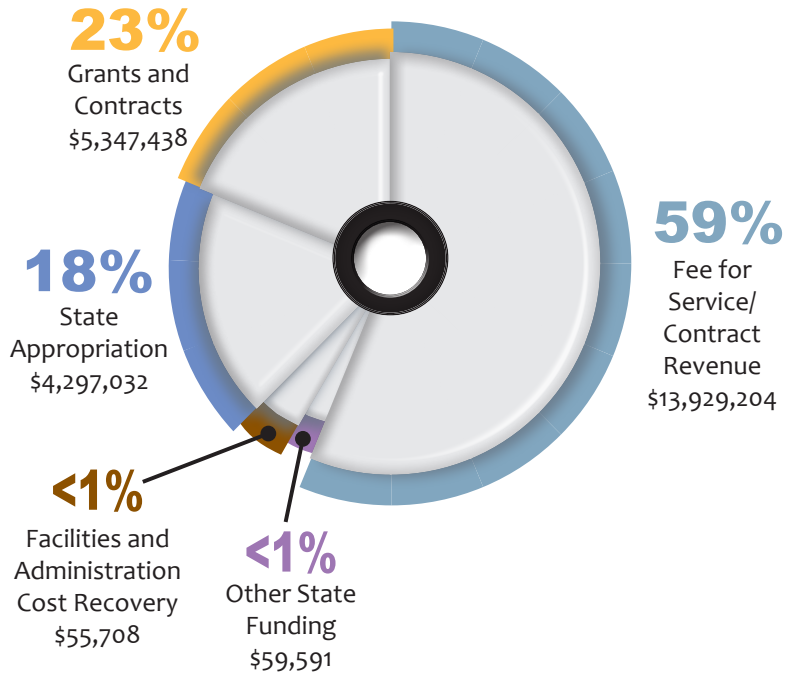
ENVIRONMENTAL HEALTH TESTING

IOWA
150,068 Analyses Performed*
70,278 Samples Submitted



REVENUE

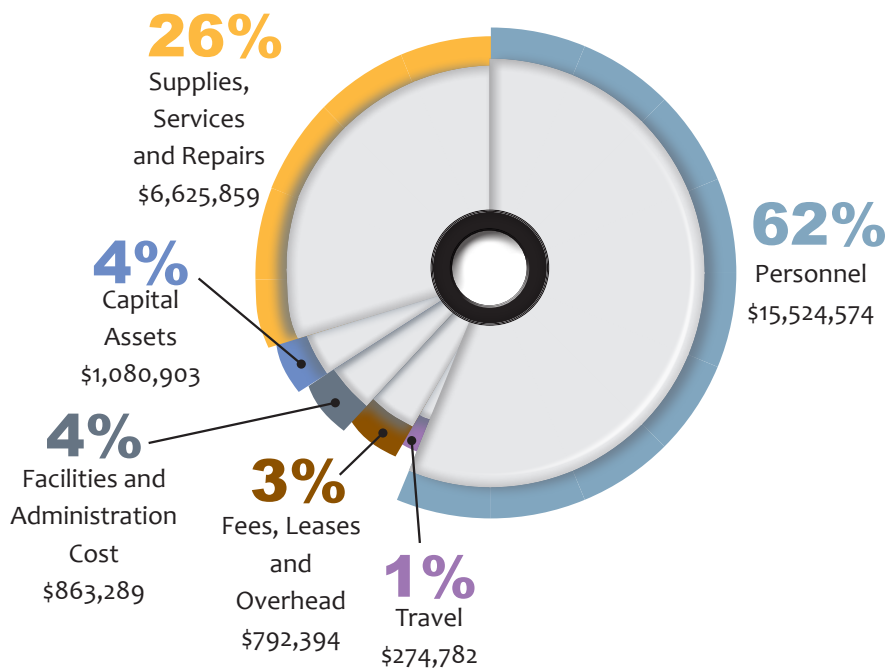
FUNDING SOURCES FOR THE YEAR ENDED JUNE 30, 2018



TOTAL OPERATING REVENUE
\$23,688,973

EXPENSES

(CASH BASIS) FOR THE YEAR ENDED JUNE 30, 2018



TOTAL OPERATING EXPENSES
\$25,161,801



The University of Iowa prohibits discrimination in employment, educational programs, and activities on the basis of race, creed, color, religion, national origin, age, sex, pregnancy, disability, genetic information, status as a U.S. veteran, service in the U.S. military, sexual orientation, gender identity, associational preferences, or any other classification that deprives the person of consideration as an individual. The university also affirms its commitment to providing equal opportunities and equal access to university facilities. For additional information on nondiscrimination policies, contact the Director, Office of Equal Opportunity and Diversity, the University of Iowa, 202 Jessup Hall, Iowa City, IA, 52242-1316, 319-335-0705 (voice), 319-335-0697 (TDD), diversity@uiowa.edu.



State Hygienic Laboratory

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